Reproduction and development of *Onchidium damelii* Semper, 1882

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No information on reproduction or embryonic development of *Onchidium damelii* Semper, 1882 has been located.

Field observations were made at Magnetic Island (19°11'S, 146°50'E) off the east coast of Australia on 34 occasions (daylight low tides) from February to December (1981). On these occasions animals were observed for evidence of copulation and areas where known onchiid populations existed were searched for egg masses.

Mating was observed from September to June. No environmental influences on copulation were noted and mating occurred at any time during the daylight low tide emergence period. No particular behavioural pattern was observed and mating appeared to be a result of chance meetings.

The non-breeding period (July, August) coincides with the coolest time of the year when sea temperatures are approximately 20 to 22°C in the Townsville area (Kenny, 1974).

Fretter (1943) recorded egg capsules for only a two to three month period in summer for *Onchidella celtica* in Britain and Stringer (1969) noted relatively short (two to three month) breeding seasons for three species (*Onchidella flavescens, O. campbelli* and *O. nigricans*) in New Zealand. Of these *O. flavescens* breeds in winter-spring (August to October) while the other two species are summer breeding forms (Stringer, 1969). A reproductive period of three to four months has been reported for *Onchidium verruculatum* but the timing appears to vary in different parts of the geographic range of the species, being listed as June to October in Kuwait (McFarlane, 1979) and December to March on the west coast of India (Deshpande *et al.*, 1980).

The present observations recorded only single pair copulation as was reported for *Onchidella celtica* by Fretter (1943), but Stringer (1963) noted that for *Onchidella nigricans* copulation may involve several individuals in the form of a ring and McFarlane (1979) observed copulatory chains of *Onchidium verruculatum.*

The recipient individuals from pairs observed mating were collected and maintained in the laboratory in high humidity on a seawater soaked substrate at 23°C until eggs were laid. Animals brought into the laboratory after observed mating laid eggs 17 to 19 days after copulation.

Egg masses, in the field, were found only attached in cavities in the buttress roots of the mangrove *Ceriops tagal.* They were approximately 6x4x0.5cms in size and of irregular ovoid shape. Random counts gave estimates of 100 to 200 thousand eggs per egg mass.

The large number of eggs recorded from egg masses of *Onchidium damelii* contrasts with the relatively small numbers noted for some other species — *Onchidella celtica,* 60 to 100 (Fretter, 1943); *O. flavescens,* 22 to 90 and *O. campbelli,* 28 to 120 (Stringer, 1969). Stringer (1969) observed much larger egg numbers — 500 to 11,000 — from egg masses of *O. nigricans.*

Awati and Karandikar (1948) reported the eggs of *Onchidium verruculatum* arranged in a single longitudinal row; the present observations showed an irregular arrangement of eggs in serveral rows for *O. damelii* egg masses.

The individual eggs of *Onchidium damelii* were spindle shaped with spike-like processes projecting from the ends of the spindle.

Egg dimensions were length, mean 0.193mm ± 0.057 (S.D.) (excluding terminal projections), diameter, mean 0.123mm ± 0.029 (S.D.); n = 26 from three egg masses.

Comments in the literature on onchidian development have not included egg sizes for other species (Fretter, 1943; Stringer, 1963, 1969).

Onchidium egg masses recovered in the field were cultured in aerated seawater (35°/₀₀) at 23°C. Eggs were removed daily and after live observation with a dissecting zoom microscope were preserved in 10% formol calcium acetate. The developmental stages of the embryos and the veliger larvae were photographed with a Zeiss photomicroscope using the Nomarski differential interference contrast method.

The embryonic stages of *O. damelii* show typical molluscan development with a spiral cleavage pattern. Development from the single cell stage to the multicell (early blastula) stage occurred within six hours from the time of laying.

The earliest veliger stage was observed on day 4 rotating within the egg capsule by means of velar cilia. The veligers undergo considerable development prior to emerging as free-swimming larvae, which were first observed on day 12. They have the appearance of characteristic gastropod veligers, with thin transparent shell, ciliated bilobed velum, small foot bearing on operculum, pair of statocysts, complete digestive tract, and well developed retractor muscle.

Live veliger larvae showed considerable variation in overall dimensions and in relative size of the velar organ. Larval length varied from 0.15mm to 0.26mm (n = 9). Fretter (1943) recorded 0.3mm as "overall length" of the veliger larva of *Onchidella celtica* and Stringer (1969) lists the "size" of veligers of *O. nigricans* as 0.21mm, *O. flavescens* 0.27mm and *O. campbelli* 0.30mm.

Veliger shell maximum diameter measurements varied from 0.14 to 0.19mm (n = 7) for *O. damelii.* Shell measurements have not been found in the literature for other species.

In the laboratory the pelagic stage lasted between seven and ten days before death occurred. Little change in the size or organization of the veligers was noticed during this phase.

Settlement or metamorphosis was not observed.

The timing of development of *Onchidium damelii* — veliger larva formed on day four, released on day 12 and free swimming for more than seven days is comparable to that given for *O. verruculatum* — veliger formed on day five, released on day 15 and free swimming for

approximately five days prior to metamorphosis (Awati and Karandikar, 1948). Stringer (1963) states the veliger of *Onchidella nigricans* is released after 25 days of development (a longer period than for *Onchidium damelii*) and is planktonic for seven days (similar to *O. damelii*).

The aquarium temperature (23°C) was near the lower limit of the recorded field temperatures and it is possible that development of *O. damelii* may be more rapid in nature.

Three species of *Onchidella, O. celtica, O. flavescens* and *O. campbelli* have been described as having direct development without a free swimming veliger phase (Fretter, 1943; Stringer, 1963). Awati and Karandikar (1948) and Stringer (1963) have described free veliger stages, from *Onchidium verruculatum* and *Onchidella nigricans* respectively.

The three species with direct development — *Onchidella celtica* (Fretter, 1943), *O. flavescens* and *O. campbelli* (Stringer, 1969) — are those with relatively small numbers of eggs in the egg masses, while two species with free swimming veligers *O. nigricans* (Stringer, 1969) and *Onchidium damelii* have large egg numbers.

Stringer (1963) related the presence of a free larval stage to the marine habitat of species; and commented that the restriction of *O. damelii* to mangrove-estuarine locations was "a link in the invasion of land". In contrast it has been suggested that *O. damelii* has reinvaded the marine habitat from the terrestrial environment (Arey and Crozier, 1921; Starobogatov, 1976; Climo, 1980). The current observations of a free swimming veliger stage in the developmental sequence of *O. damelii* support the suggestion of a distinct marine association.

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